PB81-217689

Performance of an Air Classifier to Remove Light Organic Contamination from Aluminum Recovered from Municipal Waste by Eddy Current Separation Test No. 5.03, Recovery 1, New Orleans

National Center for Resource Recovery, Inc.
Washington, DC

Prepared for

Municipal Environmental Research Lab.
Cincinnati, OH

Jul 81

U.S. Department of Commerce
National Technical Information Service
NTIS

EPA-600/2-81-119
July 1981

PB81-217689

PERFORMANCE OF AN AIR CLASSIFIER TO REMOVE LIGHT ORGANIC CONTAMINATION FROM ALUMINUM RECOVERED FROM MUNICIPAL WASTE BY EDDY CURRENT SEPARATION

Test No. 5.03, Recovery 1, New Orleans

by

National Center for Resource Recovery
Washington, D. C.

Contract No. 68-01-4423

Project Officer

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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/2-81-119	2. ORD Report
3. RECIPIENT'S ACCESSION NO. PB81 217689	
4. TITLE AND SUBTITLE Performance of an Air Classifier to Remove Light Organic Contamination from Aluminum Recovered from Municipal Waste by Eddy Current Separation. Test No. 5.03. Recovery 1. New Orleans	5. REPORT DATE July 1981
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Staff	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS National Center for Resource Recovery, Inc. Washington, D.C. 20036	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO. 68-01-4423
12. SPONSORING AGENCY NAME AND ADDRESS Municipal Environmental Research Laboratory - Cin.,OH Office of Research and Development U.S. Environmental Protection Agency Cincinnati, Ohio 45268	13. TYPE OF REPORT AND PERIOD COVERED Final
	14. SPONSORING AGENCY CODE EPA/600/14

15. SUPPLEMENTARY NOTES See also EPA-600/2-81-117, EPA-600/2-81-118, and EPA-600/2-81-120

Project Officer - Donald Oberacker 513/684-4417 (Carlton C. Wiles 513/684-7871)

16. ABSTRACT

The report describes a test in which aluminum cans recovered from municipal waste, together with known amounts of contaminant, were processed by a "zig-zag" vertical air classifier to remove aerodynamically light contaminant. Twelve test runs were conducted; the proportions of contaminant were varied and machine performance observed. For each run, the two output streams of the air classifier were analyzed to find the amount of aluminum cans and contaminant reporting to lights and heavies. The efficiency of the machine was found to vary with contaminant loading and air flow rate.

Results of these analysis, a description of the equipment under test, and a discussion of economic factors which pertain to the use of this device in an aluminum recovery system are included in this report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Resource Recovery Refuse Material Recovery Solid Waste	Solid Waste Resource Recovery	13 B

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 26
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

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FOREWORD

The Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment. The complexity of that environment and the interplay between its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems for the prevention, treatment, and management of wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, for the preservation and treatment of public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research; a most vital communications link between the researcher and the user community.

This report documents a test of an air classifier used to remove contaminant from aluminum recovered from municipal solid waste. The equipment tested is in operation at the New Orleans Resource Recovery Project (Recovery 1). It is hoped that this report yields data useful to those considering aluminum recovery through mechanical processing.

Francis T. Mayo
Director
Municipal Environmental Research Laboratory

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The report describes a test in which aluminum cans recovered from municipal waste, together with known amounts of contaminant, were processed by a "zig-zag" vertical air classifier to remove aerodynamically light contaminant. Twelve test runs were conducted; the proportions of contaminant were varied and machine performance observed. For each run, the two output streams of the air classifier were analyzed to find the amounts of aluminum cans and contaminant reporting to lights and heavies. The efficiency of the machine was found to vary with contaminant loading and air flow rate.

Results of these analyses, a description of the equipment under test, and a discussion of economic factors which pertain to the use of this device in an aluminum recovery system are included in this report.

This report was submitted in partial fulfillment of Contract No. 68-01-4423 by the National Center for Resource Recovery, Inc., under the sponsorship of the U. S. Environmental Protection Agency. Testing was carried out in December 1979 and January 1980; data analysis and reporting were completed in March 1980.

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ACKNOWLEDGMENTS

The cooperation of Recovery 1, a Waste Management, Inc., company, Mr. Norbert J. Bolda, General Manager, is gratefully acknowledged. Dr. John C. Even participated in this test program while on sabbatical leave from the Department of Industrial Engineering, Iowa State University. The Center appreciates his valuable input. Also contributing to this test were Michael Taylor, Michael Veseley, and Laurel Walters, engineering students from the University of New Orleans employed by NCRR in New Orleans on a co-op or part-time basis.

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SECTION 1

INTRODUCTION AND SUMMARY OF TEST RESULTS

INTRODUCTION

This report presents the performance evaluation of the MAC zig-zag air classifier system installed at the New Orleans, Louisiana, resource recovery facility as an AlMag product clean-up device. AlMag product is principally light-gauge aluminum, mainly cans, plus some contamination. The objective of the air classifier is to remove a portion of this contamination, namely the aerodynamically light, nonaluminum materials (called "lights"). This is one of three contaminants in the AlMag product: (1) the "lights " consist of material such as grass, paper, and plastics; (2) heavy nonmetal objects such as a banana peel; and (3) other nonferrous metal which is generally heavier than the aluminum cans and may include some aluminum castings.

The materials which fly in the air classifier are carried to a cyclone, where they drop out of the air stream into an airlock feeder, after which they are discharged as rejects and conveyed to landfill. The air is then drawn through a blower which has a throttling valve on its discharge side for system air flow adjustment; the air then passes through a stack to the outside of the building (see Figure 1 for a schematic). On occasion some cans fly rather than drop.

The objective of the series of tests whose results are reported here is to measure the base line effectiveness of the air classifier as well as the changes in effectiveness which occur when light contaminant loading is increased. Two measures of effectiveness are reported. The first, η_{al}, is based on the degree to which light-gauge aluminum drops in the air classifier, as it should. The second, η_{lite}, indicates the percentage of the light contaminant in the feed which flies, as it should.

RECOVERY 1 SYSTEM TEST

At Recovery 1, there are difficulties with the unit processes that provide the feedstock for the AlMag. These upstream processes are not as efficient in removing oversize (+4") and undersized (-2") contaminants as was anticipated. As a result, the Almag actually operates on a concentrate that is only approx-

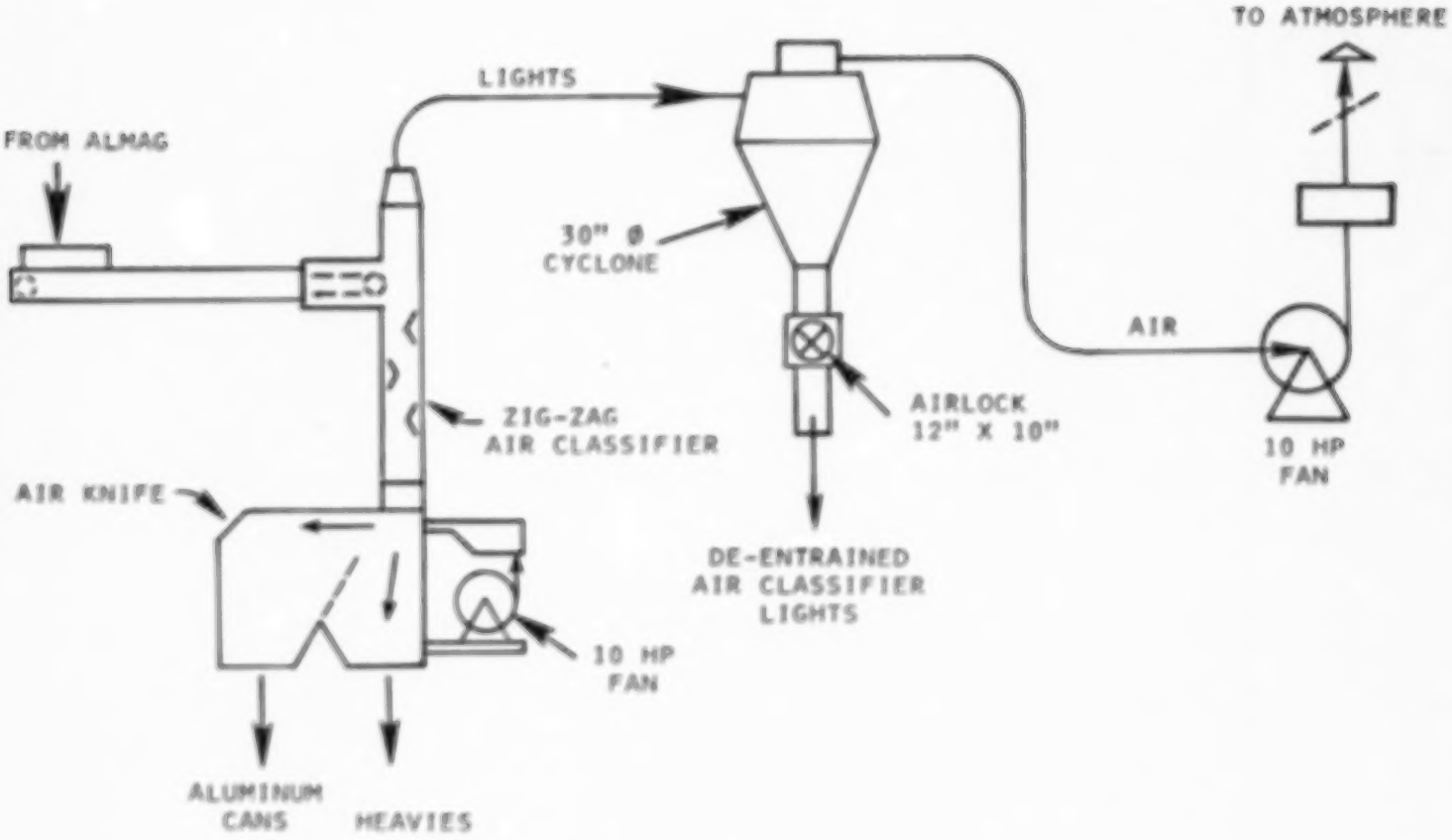

Figure 1. AlMag product cleanup system.

imately 2% light-gauge aluminum, by weight; at a throughput of approximately 2 tph, this results in 80 pounds per hour of aluminum cans.

It is expected that the upstream unit processes can be improved to the point where the AlMag feed will show a concentration of about 4% aluminum cans at a mass flow rate of 4 tph which would bring the amount of aluminum in the feedstock to approximately 300 lb/hr. For this reason, the series of tests reported here were run with material that would represent an AlMag product rate of 250 lb/hr, including the carried over contaminants. This represents an AlMag efficiency of approximately 85%.

To determine proportions to use in preparing the feed for the air classifier, actual AlMag product was collected. Three samples were taken at different times during the day. The samples were separated into four categories; (1) aluminum can-stock, (2) -4" +2" lights, (3) -2" +1/4" lights, and (4) heavies, both organic and metallic. Taking averages over the three runs resulted in percentages of 85% cans; 2%, -4" +2" lights; 1.5%, -2" +1/4" lights, and 11.5% heavies. These percentages are the "base line" contamination proportions. For each run approximately 50 pounds of material, appropriately blended, was assembled in containers convenient for handfeeding onto the air classifier infeed conveyor. Each test run was 12-minutes long which produced the nominal 250 lb/hour AlMag product rate described above.

A total of 12 test runs were made on the system: three with the base line distribution as found above; three where the objective was to double the loading of the -4" +2" fraction (from 2% to 4%); three with the loading of the -2" +1/4" fraction doubled from 1.5% to 3%; and lastly, three runs with both the -4" +2" and -2" +1/4" fractions tripled from their original base line values.

Test Results

The average for η_{lite} was 91% over all tests. In terms of the average for the two most representative runs (1 & 10), η_{al}, the percentage of cans dropped was 97.2%. Associated with this figure was a loss of 5.76 lb/hr of aluminum (the average of runs 1 & 10), which flew in the air classifier. The reason for using only two runs for the can loss computation has to do with a suspected bias in the can sample. This is explained later in this report.

An attempt was made to perform each test at the same air velocity. However, measurements could only be taken before and after the runs because the instrument must be withdrawn from the airstream during operation lest it be damaged or cause a

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blockage. In addition to measuring air velocity, the air classifier was tuned before a run by observing (through a sight glass) the behavior of whole aluminum cans fed in the air stream. Tuning was done so that, as well as could be determined visually, the whole cans hover and then drop. Unfortunately, it was discovered during testing that material accumulated on the throttling valve of the cyclone separator, restricting airflow and changing the velocity. As a result, air velocity fell off during a run, and the figures given later in this report are the average of the measured values at the beginning and the end of a run.

Therefore, inadvertently, because it was not a test objective, data was gathered on the impact of changing air velocity on performance and, as one would expect, η_{al} fell off somewhat for th higher velocity runs, while η_{lite} rose. Unfortunately, the inability to hold air velocity constant throughout each run, and over all runs, appears to have confounded the test objectives. In essence, the heavier loadings ended up with lower air velocities. Therefore, the difference in performance among light contaminant loadings could have been caused more by the variation in air velocity than by the increased proportion of lights in the feed.

Nevertheless, in terms of the overall efficiency of the air classifier, the device effectively removed light contamination and appeared to work satisfactorily at the higher loadings even at decreases in air velocity on the order of 20%. In the same range, it appears that less than a 3% loss in aluminum occurred.

ALUMINUM MARKET SPECIFICATION

The market specification for the final aluminum product states that the product, when melted in the laboratory, must yield 85% metal. If not, a penalty is assessed. This requires that the contamination by both light and heavy organics be brought below approximately 3%. Tests run on household-separated aluminum cans, which should contain almost no free organics show a 90% metal yield.

The melt loss that occurs is mainly associated with the lacquer on the can which, of course, is not metal itself, and in addition, causes a loss of nearly an equivalent amount of aluminum when it burns off in the melting process. Another loss occurs through entrainment of aluminum in the salt flux. Loose organics tend to behave like the lacquer which is the reason that 3% organics, in addition to the lacquer, the lacquer-caused aluminum loss, and the process loss all lead to approximately 85% metal after melt. It should be noted that process losses are also a function of the amount of fine material. More fines lead to greater losses. Additionally, if moisture is present in the feedstock, the metal recovered for

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any given weight of product will be less, simply because there is less metal to melt.

If the metal recovery turns out on melt to be in the 80 to 85% range, i.e., less than the 85% minimum in the specification, a penalty of $.0075 per pound of product shipped from the recovery plant is assessed, with the new unit price being applied to a slightly different base.* For a metal recovery in the 75 to 80% range, the deduct rises to $0.025 per pound. Assuming a base price of $0.30 per pound, and applying the deduct to a shipment of 100 lbs that yields 80% metal rather than 85%, reduces the revenue of the shipment from $30.00 to approximately $27.50; while a 100 pound shipment yielding 75% metal will market at approximately $24.00. To generalize, the removal at the zig-zag air classifier step of about 3 lbs of light organics per 100 lbs of product produced by the AlMag leads to approximately a 5% metal recovery improvement. For example, if this reduction in organics were to increase, the metal yield from the minimum point in the 75 - 80% range to the minimum point in the 80 - 85% range, it would be worth about $3.50 per 100 lbs of product, i.e., $0.035 per pound. This is the net of the organic improvement brought about by the air classifier minus the aluminum loss. The same 3-pound decrease in light organics would be worth $2.50 per 100 lbs if the AlMag product had been found to yield on melt test 80%, i.e., the minimum point in the 80 - 85% range and, as a result of the decrease in organics brought about by air classification, improved to better than 85%.

SUMMARY

During the tests for the base line series, the amount of light organics removed averaged slightly more than the 3 pounds per 100 lbs of product used in the example. For the tests run with greater proportions of contaminant, the amount removed correspondingly increased. Hence, if organic carryover were indeed greater than the measured base line, as could happen if the feed rate to the AlMag were increased, the zig-zag classifier would be an even more valued unit process in the aluminum recovery system.

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*New purchase price per lb shipped = base price x (metal recovery/85) - deduct. Hence, for 80% recovery, and a base price of $0.30 lb, new price per lb = $0.30 lb x .94 - $0.0075 lb = $0.2823 lb - $0.0075 lb = $0.2748 lb.

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SECTION 2

EQUIPMENT DESCRIPTION AND TEST METHODOLOGY

EQUIPMENT DESCRIPTION

The MAC zig-zag air classification system consists of a material separator plenum chamber, cyclone separator, rotary airlock feeder on the cyclone material discharge, blower, and air flow control butterfly valve, together with associated system piping. The system schematic was shown in Figure 1. Material (AlMag product) is fed into the separator plenum by means of a cleated belt conveyor that travels nominally 150 ft/min. The nominal design capacity of this system is 1,000 lbs/hr, with material bulk density in the range of 4 to 9 lbs/ft^3; the blower is driven by a 10 hp electric motor and the airlock feeder by a 1 hp motor.*

The purpose of the zig-zag is to separate the aerodynamically light nonaluminum materials from the AlMag product, which is mainly aluminum cans. The materials which fly are carried to the cyclone separator, where they drop down to the airlock feeder and out into the reject belt (along with other rejects from the recovery facility). The air flow through the system is adjusted by means of the throttling valve to just balance a whole aluminum beverage container and have it drop. Other materials that drop include grapefruit rinds, chicken bones, and pieces of nonferrous castings (e.g., auto trim). The materials that fly include paper, cloth, plastic film, leaves, as well as a few aluminum cans.

TEST METHODOLOGY

The feedstock for the test runs was obtained from the product stream of the AlMag system. This material is classified in four categories: aluminum canstock, -4" +2" lights, -2" + 1/4" lights, and heavy materials. The fractions, by weight, of the two size classes of light contaminants were the independent parameters of the tests. A total of 12 runs were made with three at each level of light contaminant. The first three runs were at the proportion of contaminant that characterizes the

*New Orleans Resource Recovery Implementation Study, National Center for Resource Recovery, Inc., September, 1977. p. 120.

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AlMag product as Recovery 1 currently operates. Each of the light contaminant levels were subsequently doubled to observe the air classifier performance with higher contamination loading. Runs 4 through 6 were conducted with 4" x 2" doubled, and Runs 7 through 9 with 2" x 1/4" doubled. The last three runs were carried out with the weight fraction of both sizes of light nonmetallic material tripled from their initial values. The reason for this relatively large jump in light contaminant was to see if the separation efficiency, η_{lite}, would degrade appreciably as a result of the higher contaminant loading. If not, then there should be very little concern about light organic carryover during aluminum separation in the AlMag.

Sample Collection

Samples for the test runs were prepared using AlMag product collected on site. In determining if a contaminant was light or heavy, it was first dropped from a height of at least 6 feet along with an aluminum can. If the can fell faster, the contaminant was determined to be light and placed in the light category for making up samples for the test run. Size determination for -4" +2" and -2" +1/4" was accomplished by screening in the laboratory. The amount of material involved in the runs was not large, with only 3.5 lbs of lights needed for the heaviest loading. Moisture determination was done on the lights after the runs were completed. There were approximately 1,000 cans used for each run. Shapes varied from flattened to only mildly deformed.

The materials that flew were collected in a 3-mil polyvinyl refuse sack placed around the discharge chute from the airlock feeder. The heavies were collected in a polyvinyl-lined cart placed under the discharge of the air knife below the air classifier; the air knife was operated as a discharge chute for these tests by disabling its blower and setting its flow splitting gate so all material dropped straight through and out.

The ratio of heavies to aluminum was not changed because this device is not intended to remove heavies. The heavy contaminants drop through and are separated by the air knife which blows the light cans away from the heavies. Because of the near proximity of these two devices, there was some concern that operation of the air knife, which was secured during the test, would affect the validity of the test results, i.e., they could not be generalized to actual operating conditions. However, when a check was run at two air flow rates for the air classifier it was found air knife operation does not affect the air flow through the air classifier and hence should not affect the validity of the classifier test results.

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After a number of test runs, it was determined that there probably was a bias in the value of η_{al}. The reason for this was the method used to reconstitute the sample of cans after each run. It was observed that the cans that were most likely to fly were those least deformed, i.e., in essentially their original cylindrical shape. Some of the sample flew each run and was not returned to the test feedstock. The method used to replace the cans was to add back to the sample a random selection of shapes. As a result, it is suspected that the sample became "harder to fly" with each successive run. It would have been more appropriate to replace the presumably "easier-to-fly" cans with mildly deformed cans only, which are the ones most likely to fly. An alternative would have been to select an entirely new representative sample, and this was done for the tenth run. Performance as measured by the indicator η_{al} declined during Run 10, but whether this was a result of unbiasing the sample or the additional lights loading cannot be determined. After declining in Run 10, η_{al} increased in Runs 11 and 12, presumably as the sample became "harder to fly." The same caveats as described above apply to this presumption as well.

System Air Flow

As mentioned in Section 1, the air flow through the system decreased during a run due to some of the light material not being de-entrained in the cyclone separator, but rather being carried to the discharge air stream. This material was typically plastic film, string, etc. It had a relatively large ratio of surface area to mass and may not have remained along the perimeter of the cyclone and dropped down along the wall as intended. Part of this problem may have been due to the occasional aluminum can that flew and could be heard to cycle for some time before discharge (evidenced by continued banging in the cyclone). This may have sufficiently disturbed the air vortex to cause some film-type material to remain entrained. This material passed the blower and became trapped in the flow control butterfly, resulting in a reduced cross section and a decrease in air flow. Before-and-after air velocity measurements were made on Runs 6 through 12 and these are shown in Table 1. Simple average air velocity values are given in Section III.

The simple average air velocity shown in Table 1 may be a biased estimator although it is not clear in which direction. If partial blockage occurred early in the run, the simple average of start and ending values is probably a high estimator. If it occurred late in the run, the converse is probably true. It is not possible to determine the timing or extent of the blockage without continuous air velocity measurements which were not obtainable.

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TABLE 1. AIR VELOCITY, RUNS 6-12

Test Run	Before Velocity (ft/min)	After Velocity (ft/min)	Run Duration (minutes)
6	4,140	2,940	12
7	4,080	3,930	12
8	4,100	3,260	12
9	4,100	3,740	12
10	4,200	3,820	8
11	4,120	3,550	8
12	3,990	3,290	8

There are several ways the throttling of the air flow can be reduced or eliminated. One would be to introduce bleed air into the blower suction side. Another method is to change pulleys or possibly use adjustable pulleys so the rotational speed of the fan can be reduced. Both of these approaches will result in less throttling being required. A third approach would be a coarse filter installed before the blower intake to trap material and prevent its reaching the fan and throttle valve; this may require frequent cleaning, however.

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SECTION 3

TEST RESULTS

TECHNICAL PERFORMANCE

As mentioned in Section 1, the basic purpose of the test series was to determine the effectiveness of the zig-zag air classifier in accomplishing its intended purpose. This is to remove light nonmetallics from the AlMag product so as to improve its marketability (performance measure: η_{lite}) and to accomplish this removal with a minimum loss of aluminum (performance measure: η_{al}). The intent was to hold air velocity constant at what is believed to be the optium setting (i.e., where aluminum cans, essentially in their original cylindrical condition, are fed to the machine with no contamination present and are observed to hover, then drop). Test runs were made at increasing loadings of light contamination. The purpose was to determine the degree of concern one should have if AlMag product contained more lights as a result of higher loadings on the unit processes before the AlMag. Even though it did not turn out that air classifier velocity was held constant (in general, it decreased as the light contaminant loading increased), it appears that the zig-zag air classifier will perform efficiently at the higher loadings.

Test Results

Loadings on a per-100-lbs-of-AlMag-product basis are given in Table 2. Test results by run are shown in Table 3. The table also shows the pounds of aluminum lost and the pounds of light contaminant removed per 100 lbs of AlMag product, i.e., feedstock to the zig-zag air classifier. The results of each of the runs averaged for each of the test conditions are given in Table 4.

Both removal of the light contaminants and recovery of aluminum canstock were relatively high. Referring to the earlier discussion of suspected bias of can recovery, Run 10 was done with an entirely new sample. Hence, Run 1 and Run 10 are probably the best indicators of η_{al}. Run 1 had the lowest aluminum recovery at 95.7%, while the recovery on Run 10 was 98.8%. This indicates that the average η_{al} taken over all runs is probably biased upwards.

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TABLE 2. COMPOSITION OF ALMAG PRODUCT

Air Classifier Feedstock (100 lb basis)

Run	Aluminum (lbs)	4" x 2" Lights (lbs)	2" x 1/4" Lights (lbs)	Total Lights (lbs)	Heavies (lbs)
1	85	2	1-1/2	3-1/2	11-1/2
2	85	2	1-1/2	3-1/2	11-1/2
3	84	3	2	5	11
4	83-1/2	4	1-1/2	5-1/2	11
5	84	4	1-1/2	5-1/2	11-1/2
6	83-1/2	4	1-1/2	5-1/2	11-1/2
7	83-1/2	2	3	5	11-1/2
8	83-1/2	2	3	5	11-1/2
9	83-1/2	2	3	5	11-1/2
10	79	6	4	10	10-1/2
11	79	6	4	10	10-1/2
12	79	6	4	10	10-1/2

TABLE 3. SUMMARY TABLE OF RESULTS, BY TEST RUN

Run	Average air Velocity ft/min	Aluminum can Recovery %	Pounds of Aluminum Lost per 100 lbs AlMag Product	4 x 2 Light Contam. Removed %	2 x 1/4 Light Contam. Removed %	Overall Light Contam. Removed %	Pounds of Contam. Removal per 100 lbs AlMag Product
1	4,365 ft/min	95.7%	3.6	100%	100%	100%	3.5
2	4,330	96.1	3.3	94.5	100	97.1	3.4
3	4,305	96.1	3.3	94.5	92.7	93.8	4.7
4	4,200	98.1	1.6	98.5	98.6	98.6	5.4
5	3,990	99.7	.2	89.2	76.8	85.8	4.7
6	3,540	99.9	.1	87.7	80.9	85.8	4.7
7	4,005	99.7	.2	90.9	92.1	91.6	4.6
8	3,680	99.4	.5	83.3	83.8	83.6	4.2
9	3,920	99.6	.3	92.1	88.0	89.6	4.5
10	4,010	98.8	.9	96.6	94.8	95.9	9.6
11	3,835	99.2	.6	91.1	87.3	89.6	9.0
12	3,640	99.6	.3	87.9	72.6	81.8	8.2

TABLE 4. PERFORMANCE MEASURES AVERAGED FOR FOUR CONDITIONS

	Test Conditions							
	Base Line		4" x 2" Increased		2" x 1/4" Increased		Both 4" x 2" and 2" x 1/4" Increased	
Test Run	η_{al} %	η_{lite} %	η_{al} %	η_{lite} %	η_{al} %	η_{lite} %	η_{al} %	η_{lite} %
First	95.7	100	98.1	98.6	99.7	91.6	98.8	95.9
Second	96.1	97.1	99.7	85.8	99.4	83.6	99.2	89.6
Third	96.1	93.8	99.9	85.8	99.6	89.6	99.6	81.8
Average	96.0	97.0	99.2	90.1	99.6	88.3	99.2	89.1

Note:

η_{al} is the percent of aluminum cans that report to the product (drop), and

η_{lite} is the percent of light materials that report to the rejects (f16)

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Runs 6, 8, and 12 show the lowest removal fractions for the light materials that tend to fly; note, however, that these runs were at the lowest average air velocities. The fraction removed of the large (-4" +2") material ranges from 83.3% to 100%, and for the small (-2" +1/4" material ranges from 72.6% to 100%. It is felt that the removal efficiency and recovery efficiency are primarily affected by the air velocity as opposed to the amount of light (flyable) contaminant at the levels considered in these test runs.

Moisture level determinations were made on the -4" +2" and -2" +1/4" material classifications that both flew and dropped as a result of the test runs. The results are obtained from oven drying the samples at 105°C and measuring the weight loss (see Table 5). From the above results, for any run, the moisture level of the -4" +2" heavies is greater than the lights except for Runs 2 and 11; for the -2" +1/4" material, it is greater for all runs. A reasonable generalization of these observations is the higher moisture content materials in these two size classifications tend to drop; moisture level may be a cause or effect for this phenomenon. Comparing the -4" +2" material to the -2" +1/4" material that flies as well as to that which drops, the moisture level of the -2" +4" material is always larger for a particular run.

ECONOMIC CONSIDERATIONS

For a given production interval, leaving the air classifier off increases the weight shipped in two ways: (1) no aluminum is lost (flown) by the air classifier, and (2) there is more light contaminant in the product. Since one is paid by the weight shipped subject to the possibility of penalty as described in Section 1, this raises the question: Does cleanup by the air classifier improve or degrade aluminum revenue, measured in dollars per hour of production?

Table 6 develops the question further. The test feed rate of 250 lb/hr was used, less an assumed 20 lb/hr of heavy contaminant removed by the air knife (which follows the air classifier). When the air classifier was on, 6 lb/hr of aluminum cans and 6-1/4 lb/hr of light contaminant were also considered to be removed. As in Section 1, $0.30 per pound is used as the basic price.

SUMMARY

As pointed out in Section 1, the change in revenue for the cleaner AlMag product (Line 1 of Table 6) is less dramatic than for the dirtier AlMag product (Line 2). The fact that some cans fly is important. If it were possible to air classify with no loss of aluminum cans, the revenue rate for cleaner AlMag product would increase by 6 percentage points per hour.

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EPA-287 (Cin.)
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TABLE 5. MOISTURE CONTENT OF ORGANIC CONTAMINANT (%)

	Particle Size			
	4" x 2"		2" x 1/4"	
Test run	fly	drop	fly	drop
1	7.3	nm	19.4	nm
2	23.8	16.1	32.3	nm
3	21.0	nm	34.1	nm
4	20.3	nm	34.9	nm
5	18.1	35.2	23.3	nm
6	19.7	nm	25.7	nm
7	17.2	30.8	30.5	48.6
8	9.4	16.3	14.4	19.1
9	13.1	20.5	23.1	34.6
10	16.9	28.5	25.6	31.3
11	15.2	12.7	25.5	36.4
12	14.0	18.7	20.4	26.8

Note: nm = not measured

TABLE 6. CHANGE IN REVENUE RESULTING FROM AIR CLASSIFICATION

AlMag Product	Metal Yield (%)		Production Rate (lb/hr)		Specific Revenue ($/100 lb product)		Revenue Rate ($/hr)	
	A/C on	A/C off	A/C on	A/C off	A/C on	A/C off	A/C on	A/C off
Cleaner	85	80	218	230	$30.00	$27.50	$65.30	$63.20
Dirtier	80	75	218	230	27.50	24.00	59.80	55.10

In the Line 1 (cleaner material) case the proceeds would rise to $67.10 per hour and in the Line 2 (more contaminated) case to $61.50. The 6 lb/hr can loss costs $1.80/hr (cleaner AlMag product) or $1.65/hr (dirtier AlMag product). Per 100 lb of product, these figures are approximately $0.80 and $0.75 respectively. The net gain from operating the air classifier is $2.50 per 100 lbs of product shipped for the cleaner case and $3.50 per 100 lbs of product shipped for the dirtier case. The interested reader can easily calculate intermediate points using the relationship given in the footnote in Section 1.